

Research on some new solutions to improve operational efficiency for wireless sensor networks

Do Duc Binh

Abstract: This thesis investigates novel solutions to enhance operational efficiency in Wireless Sensor Networks (WSNs). Addressing critical challenges such as limited energy resources, network lifetime, and data transmission reliability, the research proposes and evaluates a set of integrated approaches. The study introduces an adaptive clustering algorithm optimized for energy-balanced data aggregation, a dynamic routing protocol that leverages node residual energy and link quality, and a lightweight data compression scheme to minimize redundant transmissions. Through extensive simulations and comparative analysis against standard protocols (e.g., LEACH, PEGASIS), the proposed solutions demonstrate significant improvements in network longevity, throughput, and energy consumption. The findings indicate a reduction in average node energy dissipation by up to 25% and an extension of network stability period. This work contributes a practical framework for deploying more robust and sustainable WSNs in applications such as environmental monitoring and smart infrastructure, offering a balance between computational simplicity and performance gains.

Keywords: New solution, operational efficiency, wireless sensor network, improving efficiency